GROUP 11B

ENGINE MECHANICAL <135>

CONTENTS

GENERAL INFORMATION

M2112000100415

The unit is powered by the newly developed 135930 / 135950 engine. The total displacement is 1.3L for the 135930, and 1.5L for the 135950. Both engines are a 4-cylinder 16-valve DOHC (Double Over Head Camshaft) design.
The engine family has the following features.

- Aluminum cylinder block
- MIVEC (Mitsubishi Innovative Valve timing Electronic Control system)
- Selective valve tappet of direct acting valve system for valve clearance adjustment
- Timing chain

MAJOR SPECIFICATIONS

Item		**135930**	**135950**
Total displacement mL		1,332	1,499
Bore × Stroke mm		75 × 75.4	75 × 84.8
Compression ratio		10.5	
Compression chamber		Pentroof-type	
Valve timing	Intake opening	BTDC 41° – ATDC 9°	BTDC 41° – ATDC 9°
	Intake closing	ABDC 3° – ABDC 53°	ABDC 11° – ABDC 61°
	Exhaust opening	BBDC 35°	BBDC 39°
	Exhaust closing	ATDC 5°	ATDC 5°
Maximum output kW (PS)/rpm		70 (95)/6,000	80 (109)/6,000
Maximum torque Nm (kgm)/rpm		125 (12.7)/4,000	145 (14.8)/4,000
Fuel system		Electronically controlled multipoint fuel injection	
Ignition system		Electronic-controlled 4-coil	

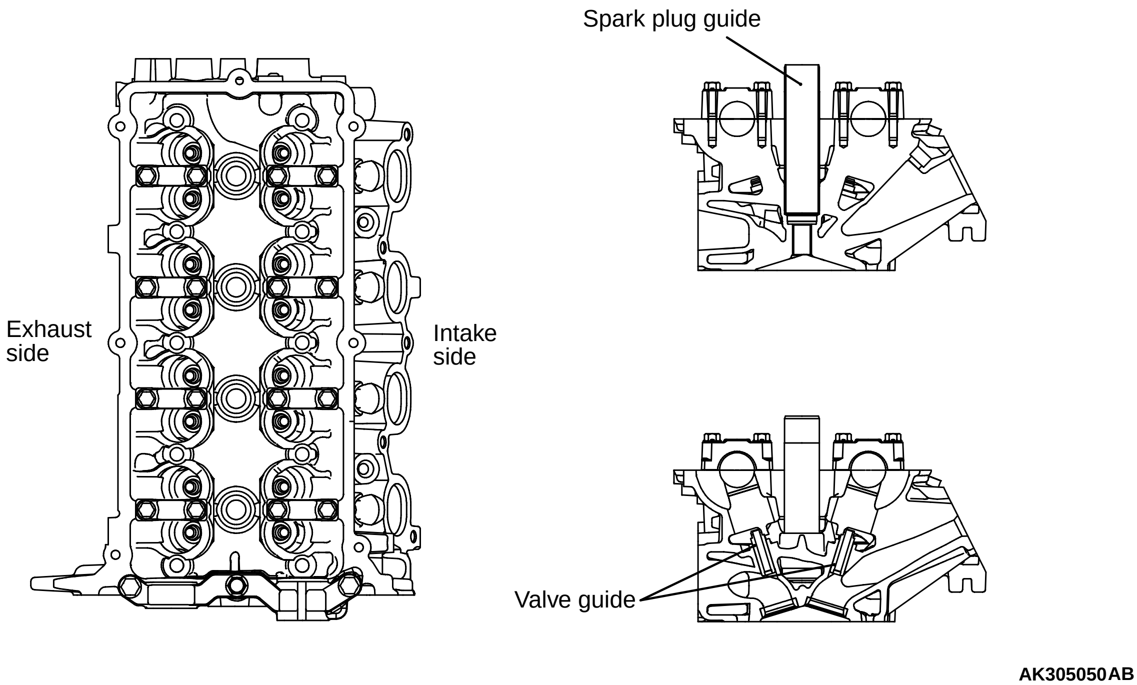
BASE ENGINE

M2112001000336

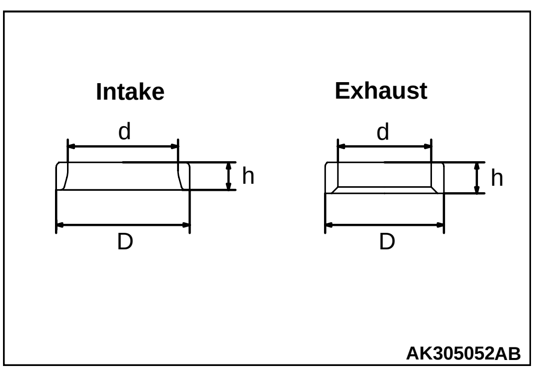
CYLINDER HEAD

The cylinder head is made of aluminum alloy, which is lightweight and has an excellent cooling efficiency. The pentroof type combustion chamber has a spark plug in the center. The valve angle is relatively small, contributing to size reduction.
The intake and exhaust ports are arranged in a cross-flow construction. Each cylinder has a pair of intake ports on one side and a pair of exhaust ports on the other side.

Each of the intake and exhaust camshafts is supported by 5 bearings. On each camshaft, the thrust load is supported by No. 1 bearing. The No. 1 bearings for the intake and exhaust camshafts have a common bearing cap.



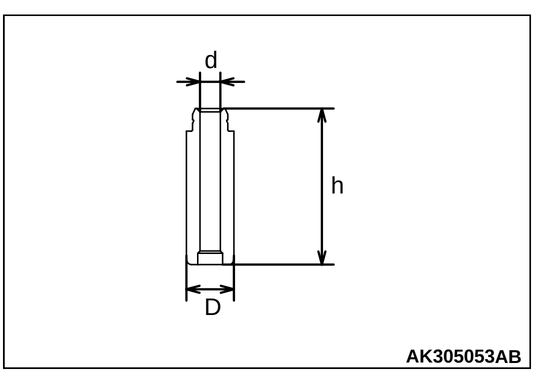
VALVE SEAT



Sintered alloy valve seat

Item	Intake	Exhaust
D (Outer diameter) mm	31.5	28
d (Inner diameter) mm	26	22
h (height) mm	6.6	7.3

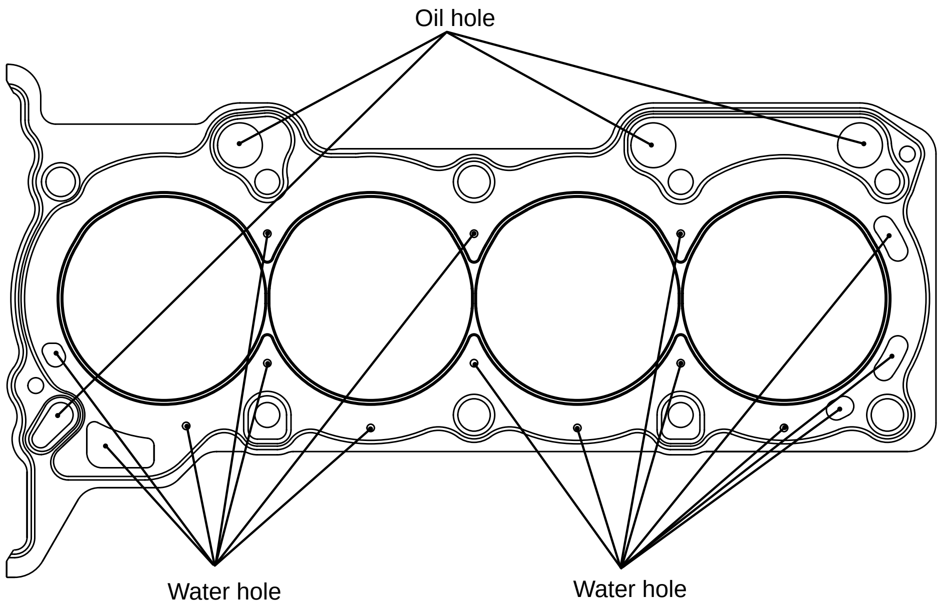
VALVE GUIDE



The intake and exhaust valves use the same-design valve guide.

Item	Intake
D (Outer diameter) mm	10.5
d (Inner diameter) mm	4.5
h (height) mm	34.5

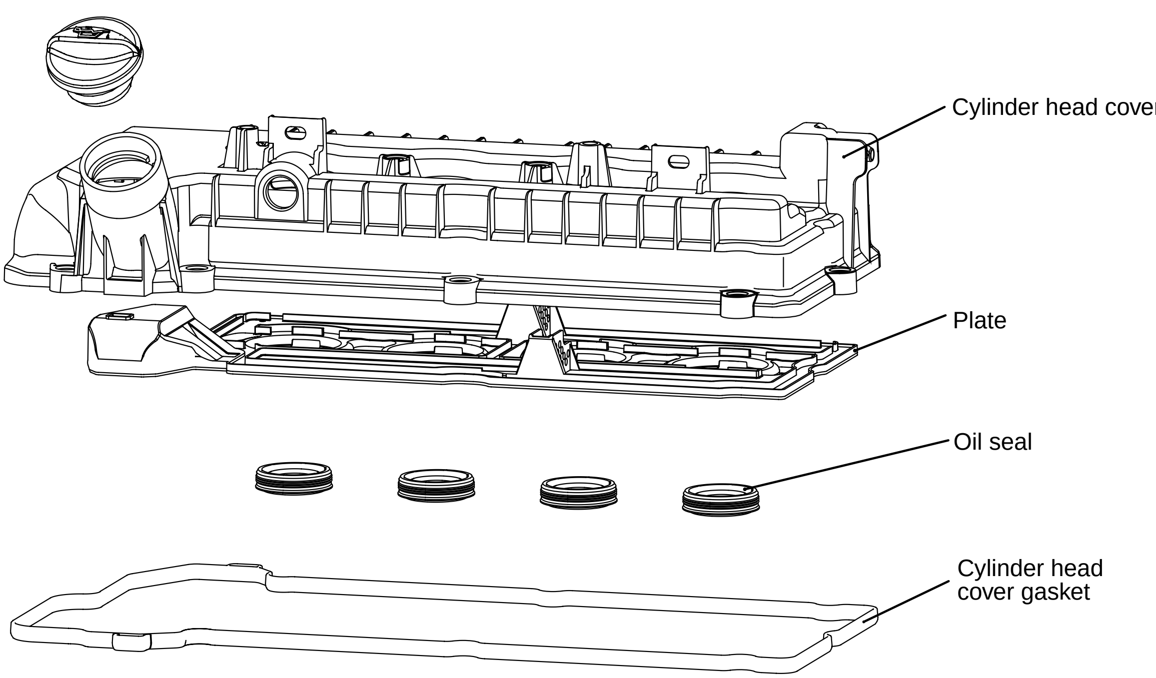
CYLINDER HEAD GASKET



AK305054AB

The metal gasket having the one layer of wave stopper is used for the cylinder head gasket.

CYLINDER HEAD COVER

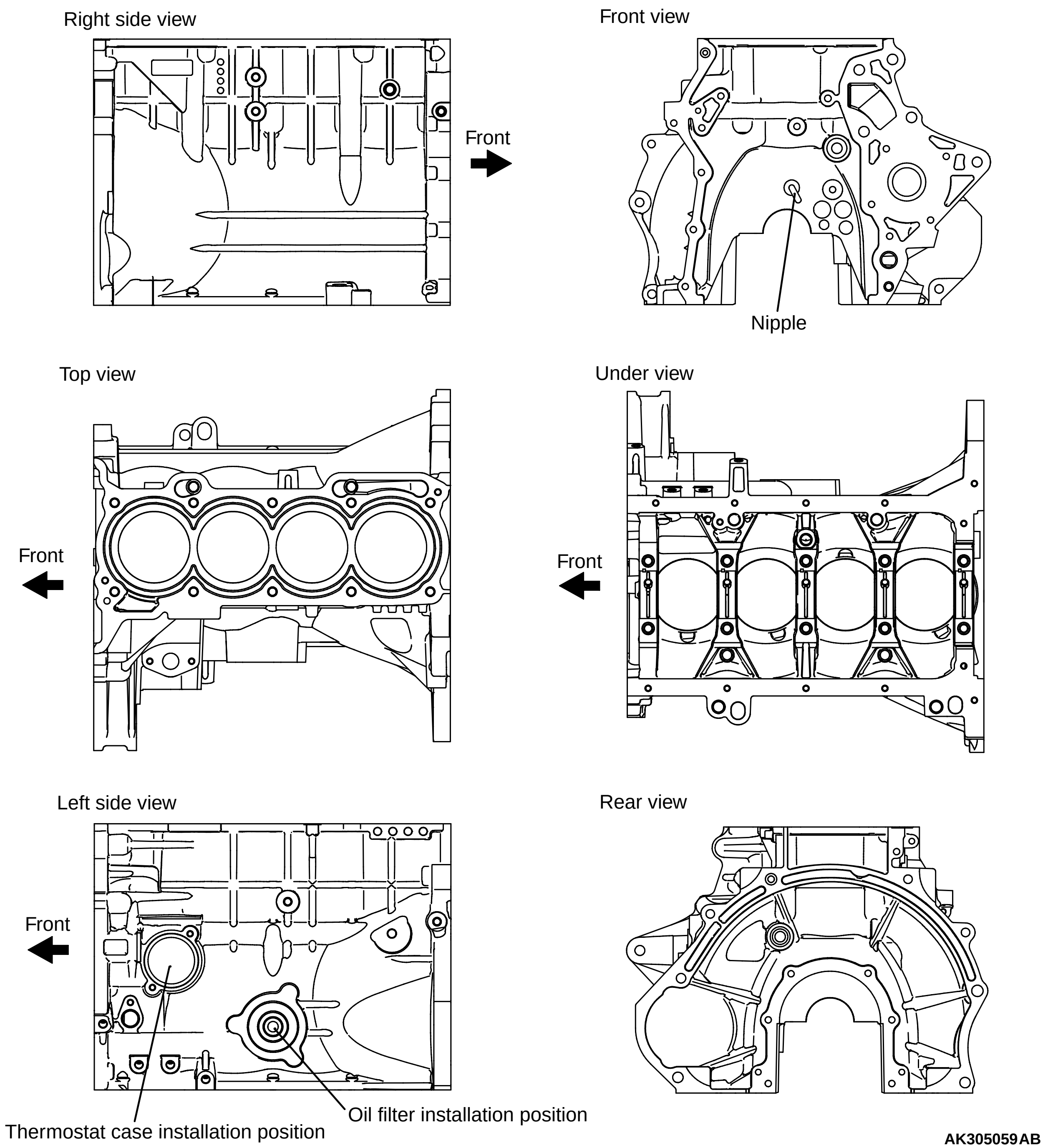


AK305056AB

A resin cylinder head cover is used for the cylinder head.

The oil plate and the oil seal are integrated with the cylinder head cover assembly.

CYLINDER BLOCK

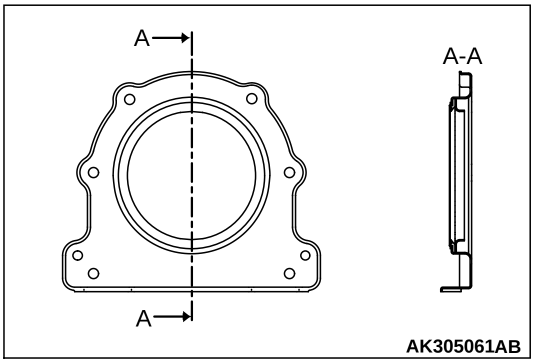


The cylinder block is made of lightweight aluminum alloy.
The crankshaft journal is supported by 5 bearings.
The crankshaft thrust load is supported by No. 4 bearing.
The water jacket is of a full-siamese design.
A nipple is provided at the front of the block to supply engine oil onto the timing chain.

Item	Dimension
Overall height mm	280
Overall length mm	375.1
Top face to crankshaft center mm	205
Crankshaft center to bottom face mm	75
Bore mm	75

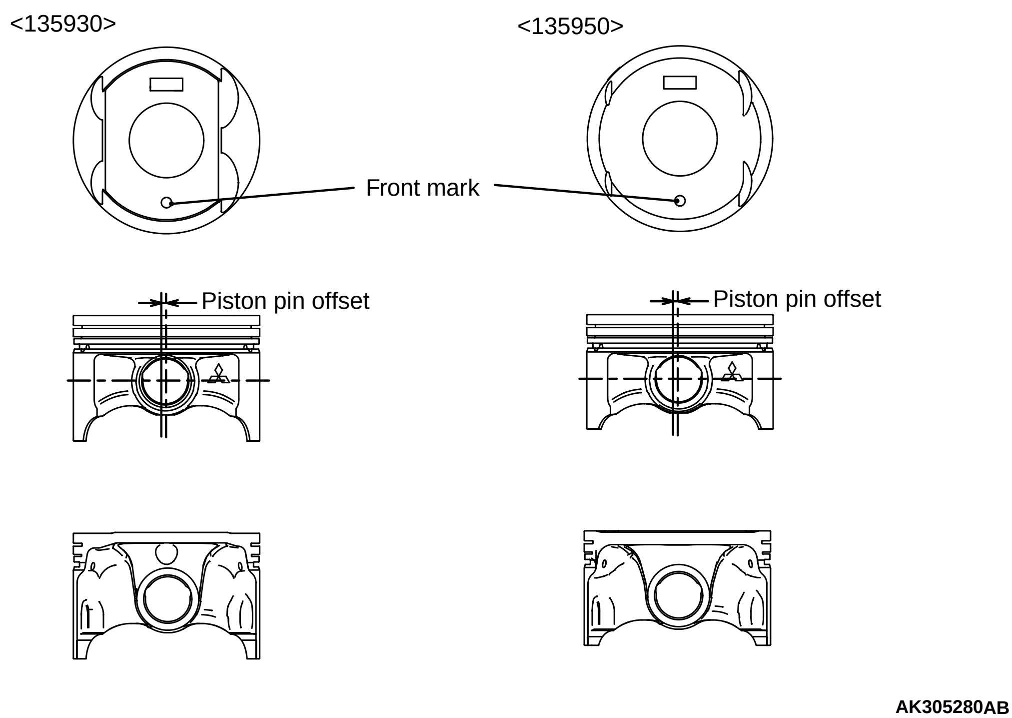
Item		Dimension
Bore pitch mm		83
Stroke mm	135930	75.4
	135950	84.8

REAR OIL SEAL CASE



The rear oil seal case is a sheet-metal work. The case is installed with sealant applied onto the mounting face to prevent oil leakage.

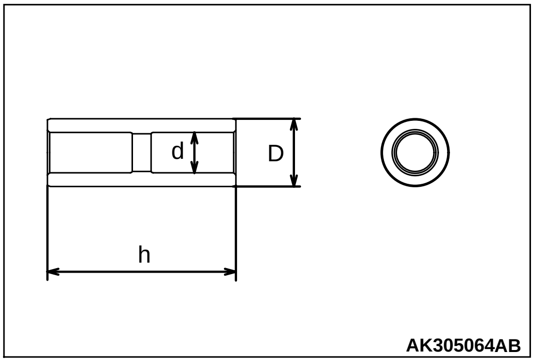
PISTON



The piston is made of special aluminum alloy. Weight reduction is achieved by minimizing the overall height while maximizing the recess on both ends of the piston pin.
The center of the piston pin hole is offset by 0.5 mm from the center of the piston towards the thrust side.
The piston skirt has a streak finish to enhance oil retention and anti-seizing property.

Item		Dimension
Base diameter mm		75
Pin diameter mm		18
Overall height mm	135930	50.46
	135950	46.04

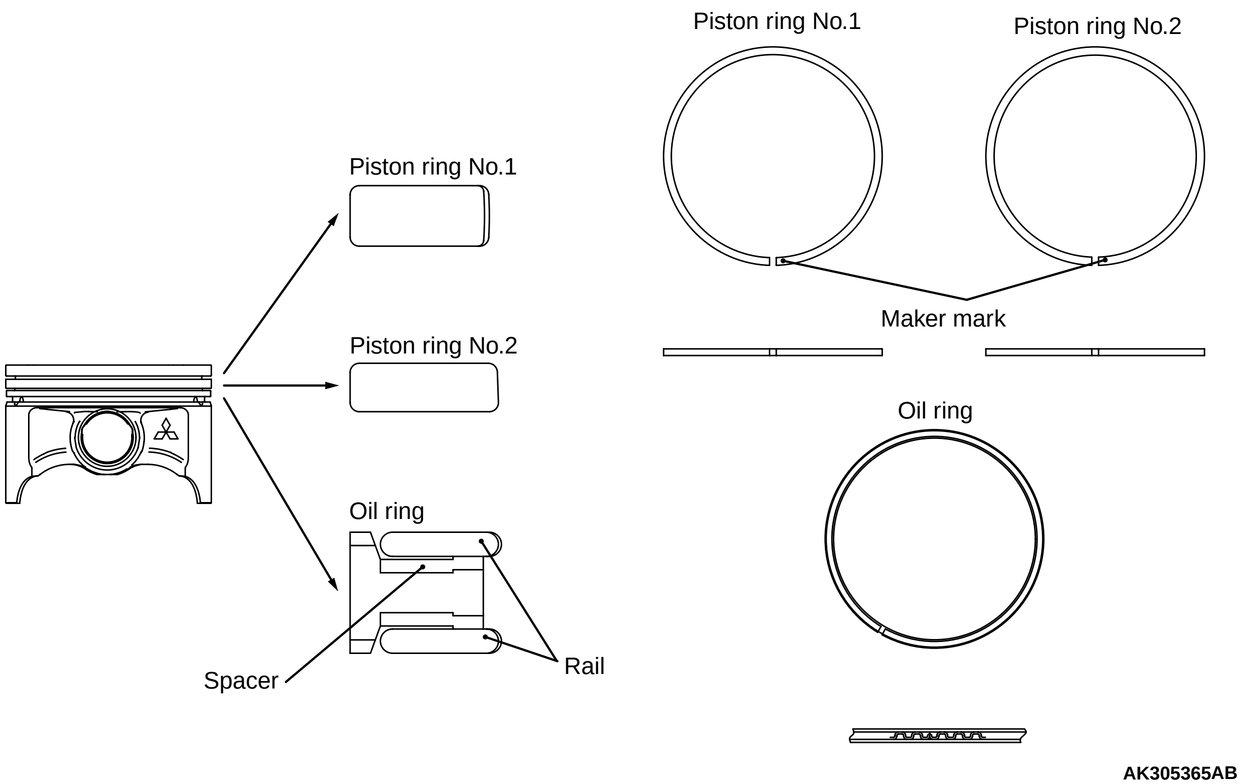
PISTON PIN



The piston pin is of a semi-floating type, press-fitted into the connecting rod small end while capable of floating relative to the piston.

Item	Dimension
D (Outer diameter) mm	18
d (Inner diameter) mm	11
h (Overall length) mm	50

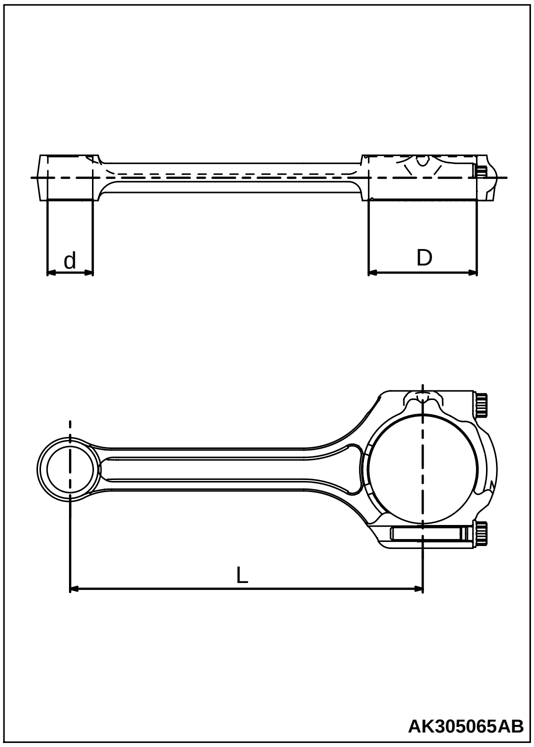
PISTON RING



Each piston is provided with No. 1 and No. 2 compression rings and an oil ring.

Item	No. 1 piston ring	No. 2 piston ring	Oil ring
Shape	Barrel	Tapered	3-piece
Surface treatment (Contact face with cylinder)	Nitride coated	Parkerized	Hard chrome plated
Maker mark	R	2R	No marking

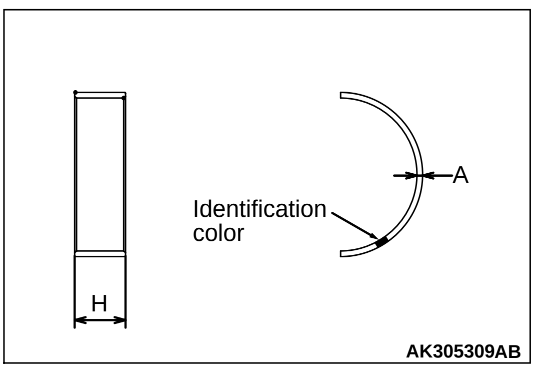
CONNECTING ROD



The connecting rod is made of highly rigid, forged carbon steel. The rod portion has an H-shaped cross section.
The connecting rod big end bearing is lubricated through an oil passage running from the main journal to the crankshaft pin.

Item		Dimension
d (Small end inner diameter) mm		18
D (Large end inner diameter) mm		43
L (Center distance) mm	135930	140.3
	135950	135.6

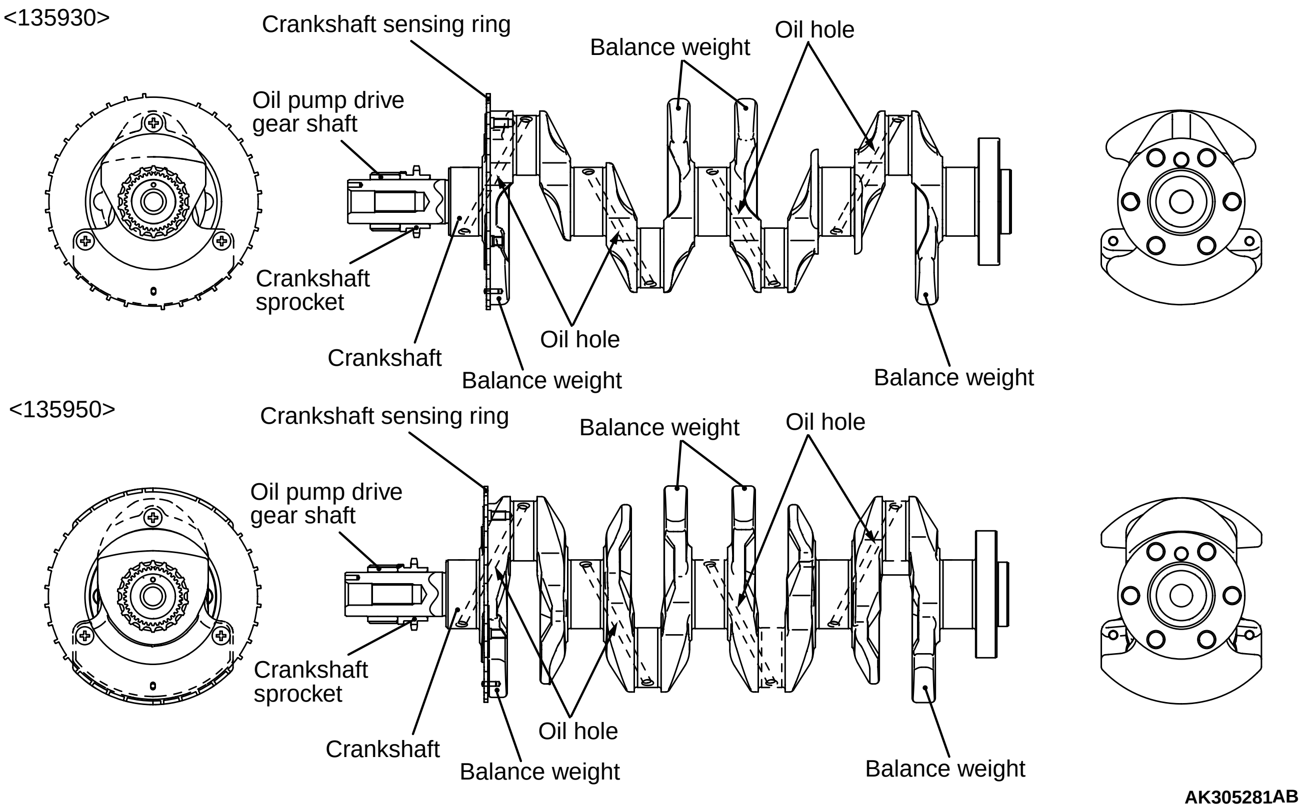
CONNECTING ROD BEARING



The upper and lower connecting rod bearing halves are identical.
The connecting rod bearing is equipped with back metal. While the bearing itself is made of aluminum alloy, the back metal is normally made of steel sheet.
The connecting rod bearing is narrower than the bearing cap, this is to minimize wear.

Item	Dimension
H (Width) mm	13.5
A (Thickness) mm	1.5

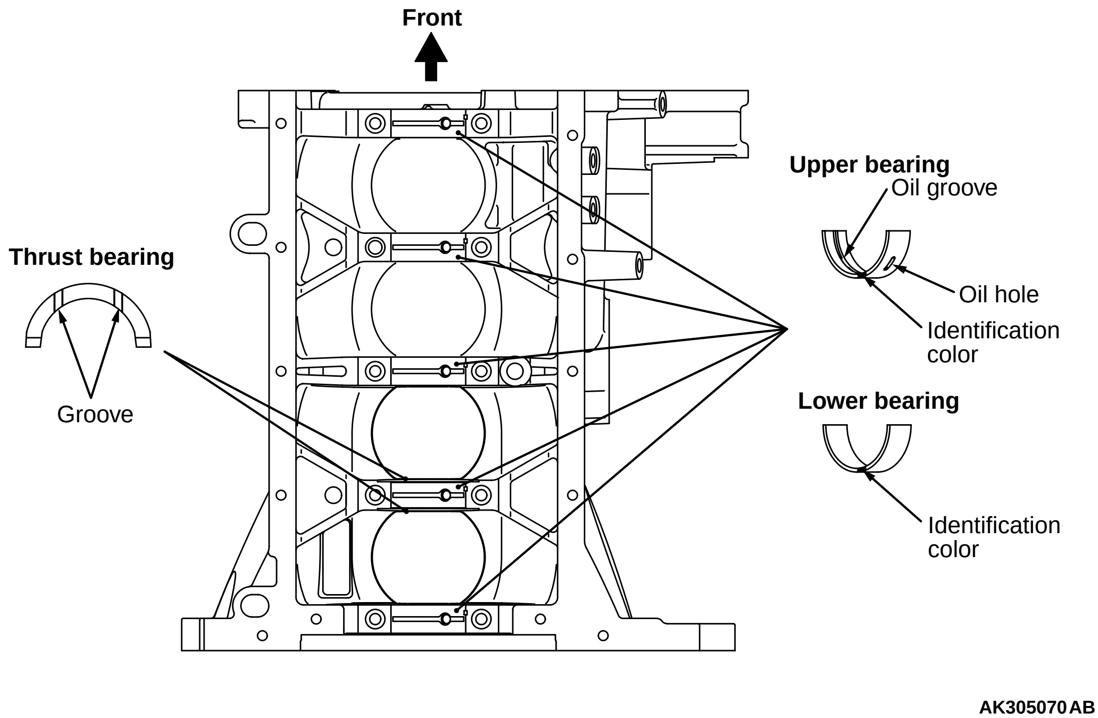
CRANKSHAFT



A casted crankshaft is used for the crankshaft.
The crankshaft consists of 5 main bearings and 4 balance weights for 135930 or consists of 5 main bearings and 8 balance weights for 135950.
The crankshaft pins are arranged at 180° intervals.

The oil hole supply lubrication oil from the journal to the crank pin.
A crankshaft sprocket and an oil pump drive gear shaft are press-fitted onto the front of the crankshaft. The crankshaft is also fitted with a crankshaft sensing ring.

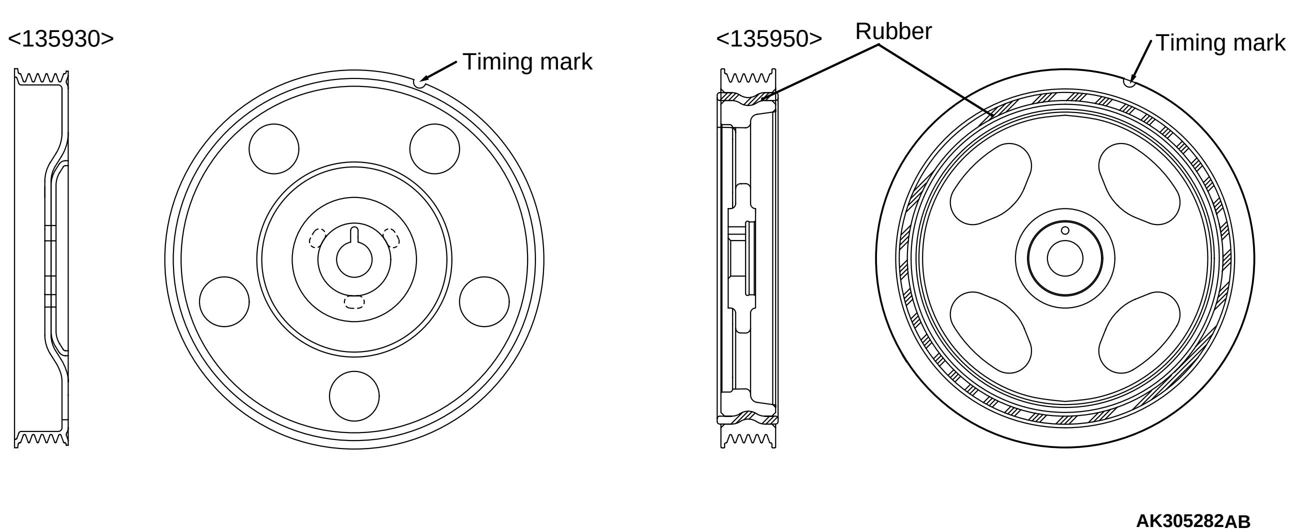
CRANKSHAFT BEARING, THRUST BEARING



The upper crankshaft bearing (with oil groove) is located on the cylinder block side while the lower bearing (without oil groove) is held by the bearing cap.
The crankshaft bearing is equipped with back metal. While the bearing itself is made of aluminum alloy, the back metal is made of steel sheet.
A thrust bearing is installed on both sides of the No. 4 crankshaft bearing.

Item			Dimension
Crankshaft bearing		Width mm	16
		Thickness mm	20
Crankshaft thrust bearing	Thickness mm	135930	3.275
		135950	3.275

CRANKSHAFT PULLEY

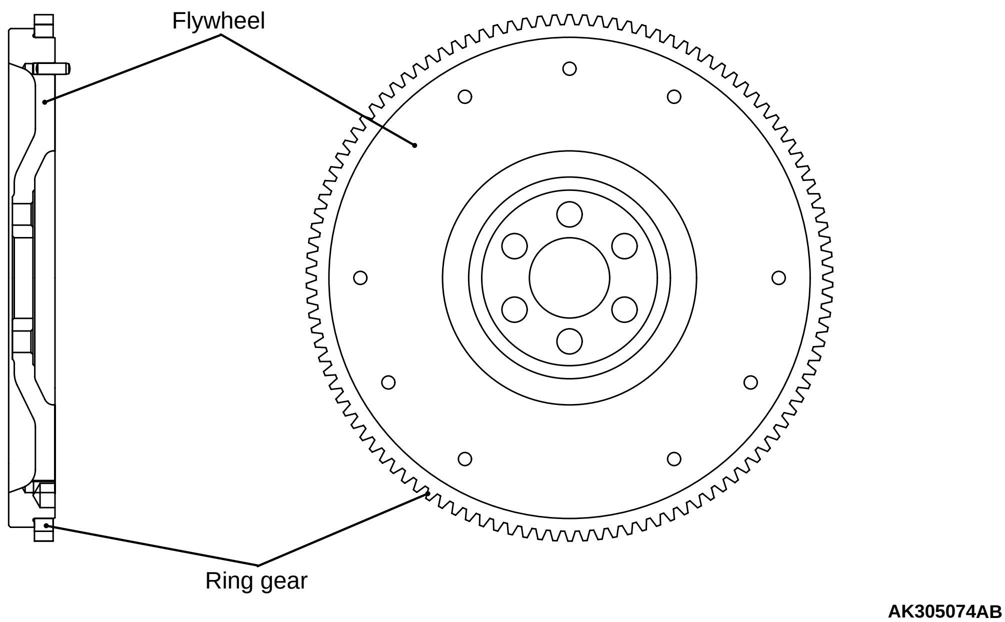


A steel billet crankshaft pulley is used for 135930. The pulley has grooves to engage with a V-ribbed belt (5 ribs), which drives an alternator and a water pump.

An ignition timing mark (notch) is stamped on the flange of the pulley.

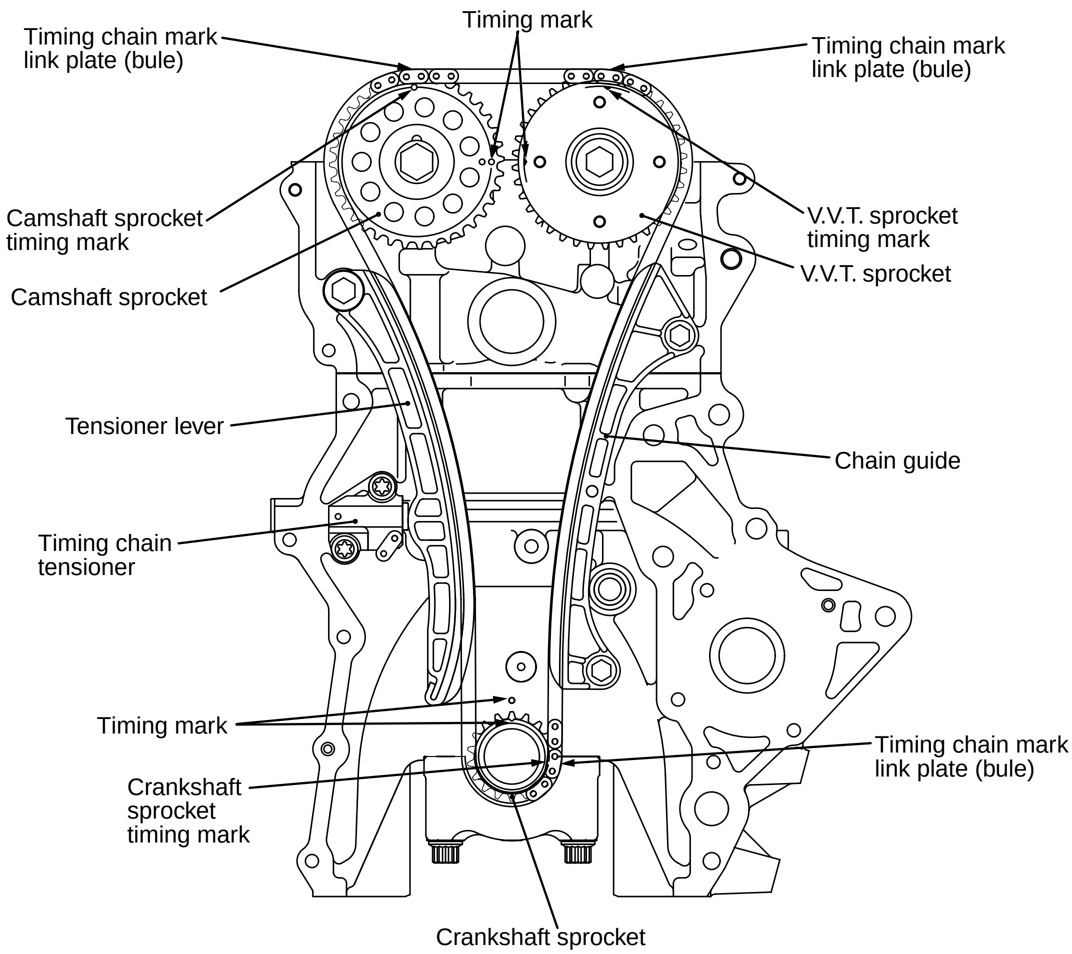
The crankshaft pulley for 135950 is equipped with a torsional damper to minimize the torsional vibration of the crankshaft as well as substantially reduce noise and vibration at the high speed range.

FLYWHEEL



The flywheel is made of cast-iron. A separate ring gear is mounted on it.

TIMING CHAIN TRAIN

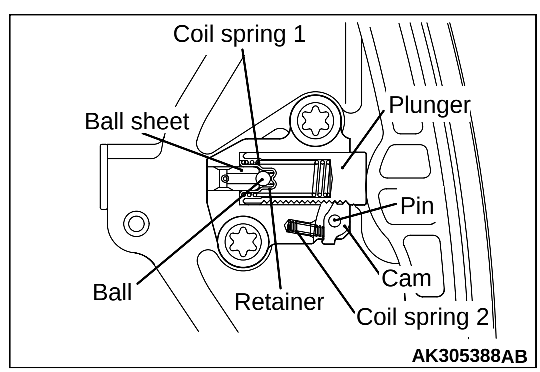


AK305075AB

The 2 camshafts are driven by the timing chain via the respective sprockets.
The timing chain, consisting of 122 links, is an endless chain, connecting the crankshaft sprocket with the camshaft and V.V.T. sprockets.
The timing chain is equipped with 3 mark link plates (blue) to correctly time the 3 sprockets with each other.
The timing chain is tensioned by the timing chain tensioner, which has a built-in plunger with plunger springs.

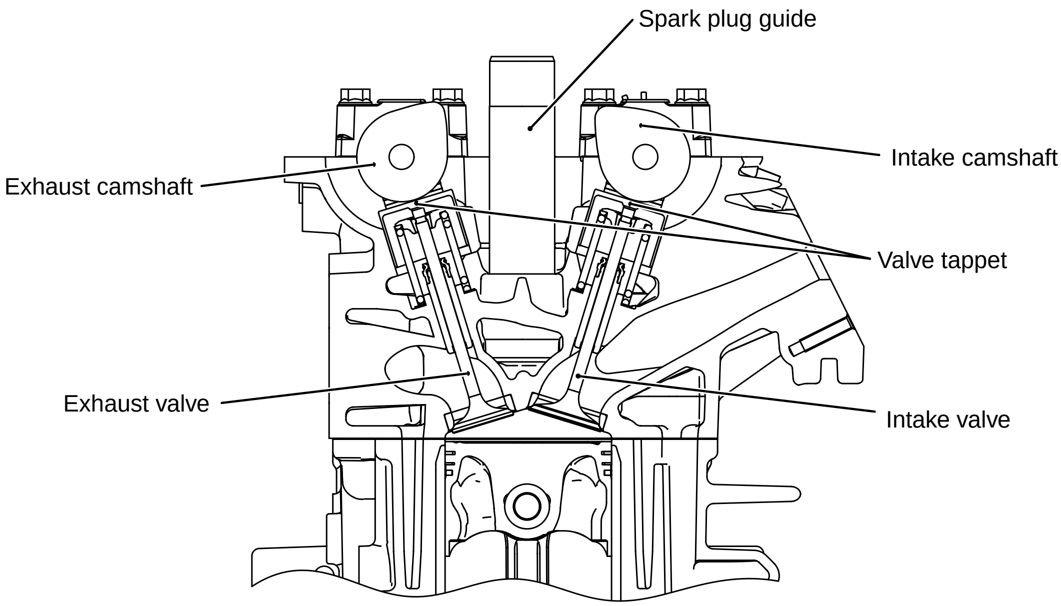
Item	No. of teeth
Camshaft sprocket	36
V.V.T. sprocket	36
Crankshaft sprocket	18

TIMING CHAIN TENSIONER



The plunger in the timing chain tensioner directly pushes the tension lever, and the pressure automatically adjusts the timing chain tension.
A cam is provided to lock the plunger in place after the engine stops. This helps prevent the timing chain from wobbling just after the engine starts.
With the timing chain tensioner installed, do not crank the engine in the reverse direction. This will force the plunger to overcome the cam, or even cause other problems.

VALVE MECHANISM

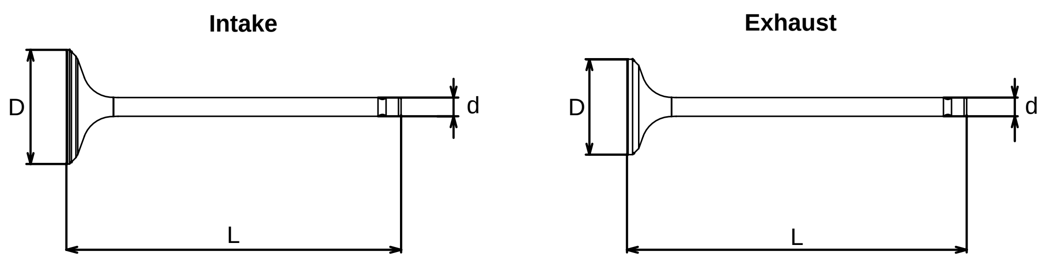


AK305076 AB

The valve mechanism is based on a 4-valve DOHC (Double Over Head Camshaft) design having the camshaft on the upper valve. Each cylinder has 2 intake valves and 2 exhaust valves, arranged in a V-shape pattern.

Camshaft rotation is transmitted via valve tappets to the respective valves which open and close accordingly.

VALVE

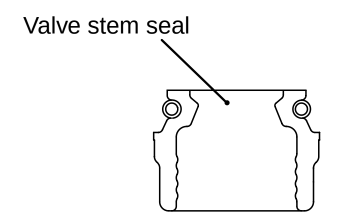


AK305078 AB

The valves have heat-resistance. The entire valve surface is treated with gas nitriding.

Item	Intake valve	Exhaust valve
Head diameter mm	30.5	25.5
Stem diameter mm	5.0	5.0
Overall length mm	89.61	90.94

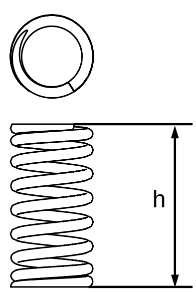
VALVE STEM SEAL



AK305079AB

The valve stem seal employs springs to enhance sealing performance, minimizing oil passing down to the port.

VALVE SPRING

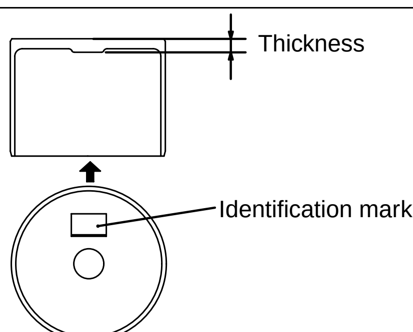


AK300721AB

The valve spring has a dual pitch spring to prevent surging in the high speed range.

Item	Specification
Free length mm	43.1
No. of spring turns	8.49

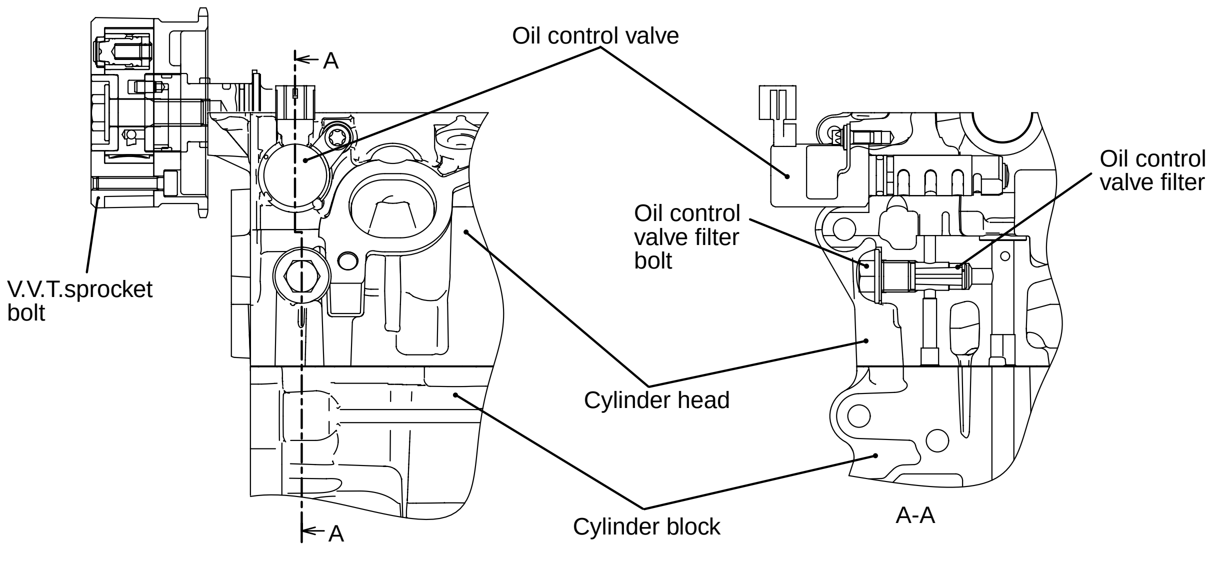
VALVE TAPPET



AK300722AB

Valve tappets are available in 31 thicknesses, at 0.02 mm intervals between 2.70 mm and 3.30 mm, to ensure correct valve clearance.

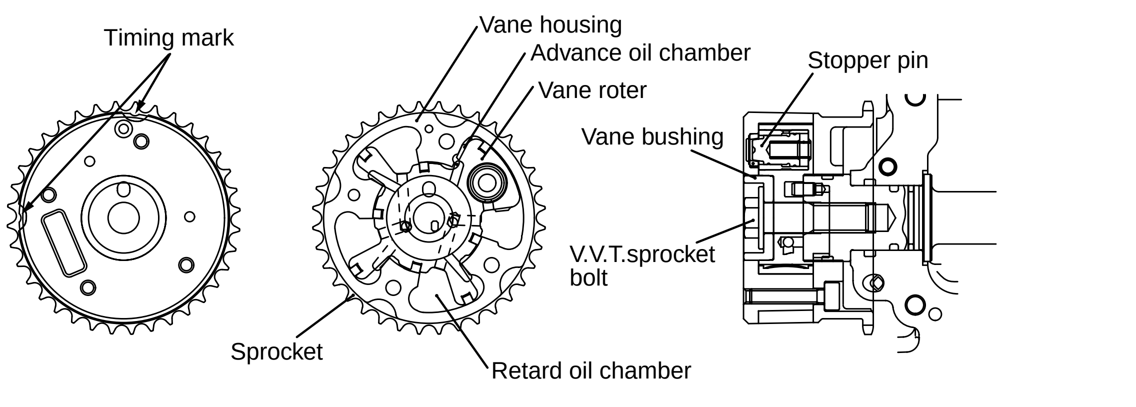
MIVEC (MITSUBISHI INNOVATIVE VALVE TIMING ELECTRONIC CONTROL SYSTEM)



MIVEC (Mitsubishi Innovative Valve timing Electronic Control system) consists of the components illustrated above.

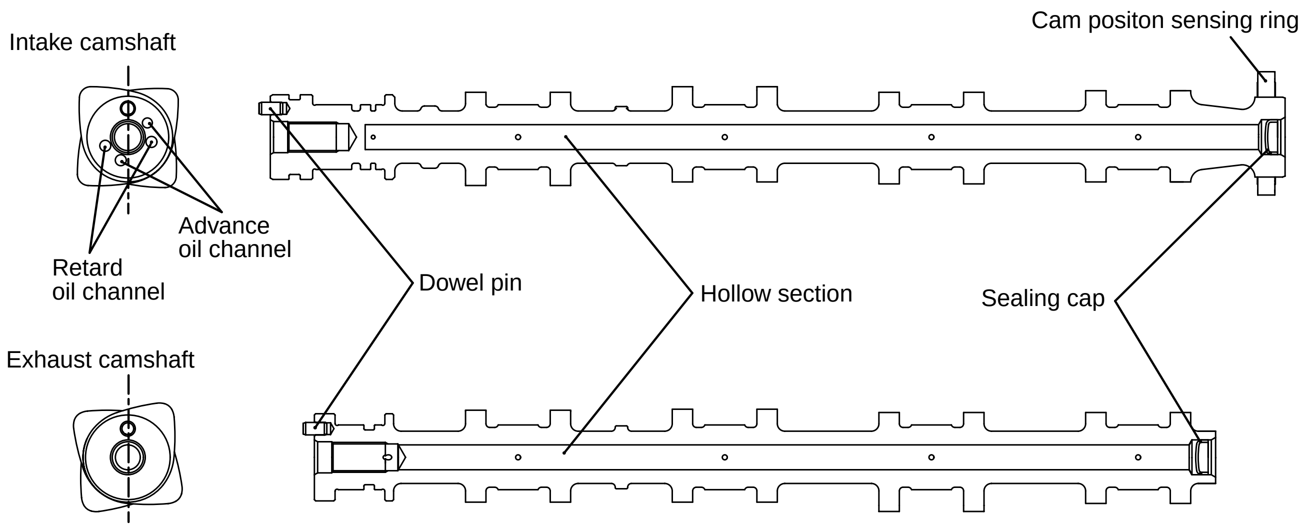
The intake valve timing is optimally controlled (continuously variable) under the changing driving conditions to improve power in the entire speed range.

V.V.T. SPROCKET (VARIABLE VALVE TIMING SPROCKET)



Oil from the oil control valve is sent to the V.V.T. sprocket, moving the vane rotor and thus regulating the valve timing.

CAMSHAFT

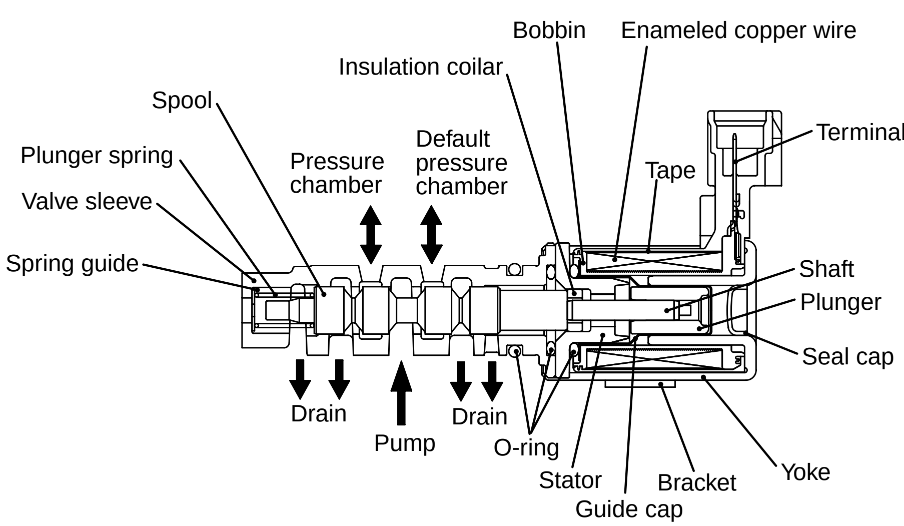


AK304999AB

The lightweight camshaft is achieved by the hollow design.
Oil channels run through the intake camshaft, through which oil is sent from the oil control valve to the V.V.T. sprocket.
A cam position sensing ring is press-fitted onto the rear portion of the intake camshaft.

Item			Dimension
Overall length mm	Intake		407.5
	Exhaust		361.9
Journal mm			26
Valve lift mm	Intake	135930	7.9
		135950	8.4
	Exhaust	135930	7.6
		135950	7.9

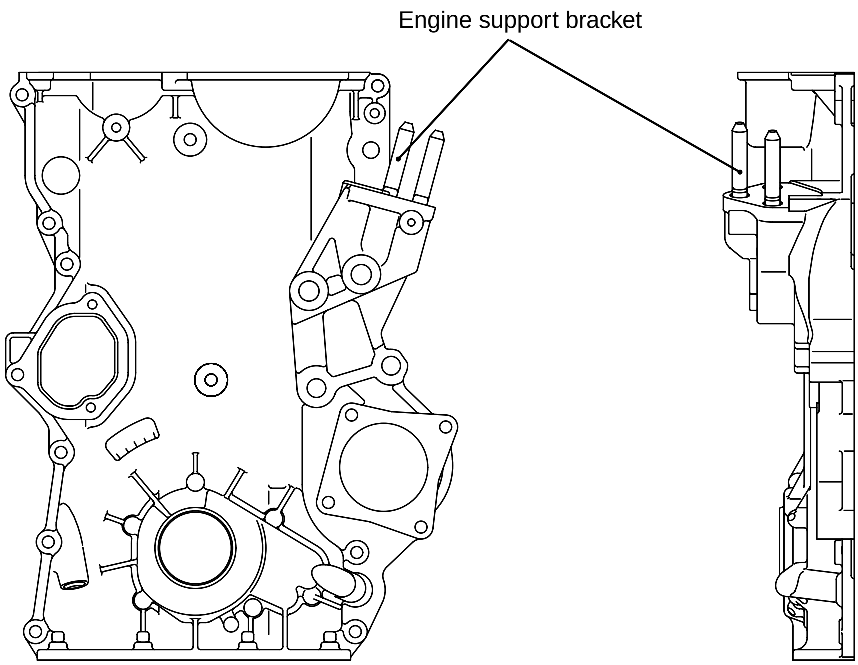
OIL CONTROL VALVE (OCV)



AK302997AB

The oil control valve is essentially a solenoid valve, regulated by the engine-ECU or engine-A-M/T-ECU signals to feed oil to the V.V.T. sprocket assembly to move the vane rotor.

TIMING CHAIN CASE



AK305243AB

The engine support bracket, the oil pump and the relief valve are integrated as well as water chamber of the water pump.